have been 8,296,496, and in the latter 8,577,954 animals left wounded.

Then with regard to the holders of gun licences. It does not seem an excessive estimate to suppose that each wounds on an average two animals (birds, almost exclusively, in this case) a week throughout the year of fifty-two weeks. A great proportion of holders of these licences no doubt do not exercise their privilege every week. Many of them do so only with the object of protecting their crops; but the season for fruit and garden vegetables goes on all the summer, say from May to September, and the harvest lasts six weeks, while for some three weeks before that begins the corn is ripening, and is then most attractive to sparrows. A single shot into a flock of sparrows will wound many more than it kills, and such shots, as our ears tell us, are frequent during the day. It does not seem possible to place the average number of birds wounded by each holder of a gun licence lower than we have done. We have therefore to multiply the number of holders by 104 (= 52 × 2), and then we find that in 1873-4 there must have been 13,731,744, and in 1874-5, 15,004,912 animals left wounded by this class of persons.

Adding the two sets of numbers, we have a grand total for the former of these years, 22,028,240, and for the latter, 23,582,866 wounded; while this increase of over 1,500,000 in one twelvemonth forbids our supposing that the next Report would show much, if any, diminution.

Just as before we purposely abstained from distressing our readers by dwelling on the effects of all this wounding, so now we purposely abstain from using any strong language, or calling those who shoot by bad names. This is not meant to be a sensational article. We are sure in our own mind that sportsmen are not by nature cruel—very far from it. Yet, if we may trust our figures, here are the plain facts that acute pain of uncertain duration was, in the year ending March 31, 1874, inflicted upon *over twenty-two millions* of animals, and in the following year upon *over twenty-three millions and a half* in the British Islands. We are not aware that we possess any bias that would make us exaggerate our estimates to produce these results. Our only object is to attempt as near an approximation to the truth as we can. The figures stand for themselves, and if anyone thinks he can furnish fairer averages let him give his *data* for them. We are, as it is, willing to guard against any unconscious exaggeration and to knock off more than 10 per cent. of our grand totals, so as to say roundly that only twenty millions have suffered in each year. But we would invite our readers to reflect on the proportion which even that number bears to the number of animals which during the same time have been subjected to experiment by the physiologists of this country. The latter have been by many excellent persons held up to obloquy as monsters of cruelty. If this has been done justly what must they think of those who use the gun?

BLASERNA ON MUSICAL SOUND

The Theory of Sound in its Relation to Music. By Prof. Pietro Blaserna, of the Royal University of Rome. With Numerous Woodcuts. International Scientific Series. (London: Henry S. King & Co., 1876.)

OF the many valuable works which have appeared in the International Scientific Series, none deal with a better subject than that of Prof. Blaserna. "The student of physics," he says truly in his Preface, "does not go much into the study of musical arguments, and our artists do not sufficiently understand the very important bearing that the laws of sound have upon many musical questions."

The first three chapters of the book hardly call for detailed notice. They reproduce the familiar facts of acoustics lucidly and succinctly. Vibration, its transmission and velocity, echo, noise as contrasted with musical sound reinforcement by sympathy, sounding-boards and resonators, complete the first division of the subject. The second begins with measurements of vibration, graphically or by means of the siren. The limits of audible sounds are thus determined to lie between 16 and 38,000 per second; of the human voice between the 61 vibrations of double B is the bass, and the 1,305 of the soprano F in alt.

The importance of uniform pitch is adverted to. Its invariable rise, in the course of years, is explained by the "tendency of manufacturers of musical instruments, especially those made of brass, to raise the pitch continually, in order to give a greater brilliancy of tone to their instruments;" an indictment in which the players might justly have been included as well as the manufacturers.

The harmonic series, and its demonstration by means of the sonometer, conclude the fourth chapter. The laws of ratios, of interference, and of beats, with their resultant notes, occupy the fifth. From these the ancient Greek scale, attributed to Pythagoras, is built up, and compared with our modern scale, the youngest member of which, the minor third, "was only adopted in the seventeenth century, with many reservations, together with the harmony of the sixth, from which it can be easily derived."

Of the harmonic seventh (rather awkwardly termed throughout "the seventh harmonic") it is judiciously observed that "to an ear accustomed to our music, it may appear unpleasant; but an unprejudiced examination, according to the opinion of some—an opinion with which I entirely agree—shows that it is rather strange than unpleasant; that in certain special cases it affords very good discords and passing chords, and that the strangeness arises rather from our want of familiarity with it than from its inherent nature. Without wishing to push too far forward, and to prophecy what will happen in the future, it may be observed that the systematic introduction of the harmonic seventh into music would produce in it a very deep and almost incalculable revolution, a revolution which does not seem justifiable, because, for our magnificent musical system, another would be substituted, perhaps as magnificent, but certainly not better, and probably worse, at any rate more artificial."

Helmholtz's double siren is described at some length, and illustrated by numerical examples, carrying the student on to chords of three or more notes; the marked difference in character between the major and minor common chords being attributed to the disturbing effect of the resultant notes in the latter, which is absent in the former. Even Mozart shows "a certain reluctance to use the minor as a closing chord. It may be that the most highly gifted musical natures have, as it were, felt beforehand that which theory has since been able to explain in a simple and conclusive way." Discords and their contrast with concordant intervals lead to a comparison of music

with the other fine arts, and to a sketch of its history, which is less satisfactory than other portions of the work. The following account of Hebrew music is quaint in the extreme:—"David and Solomon were very musical. They composed psalms full of inspiration, and evidently intended to be sung. To the latter is due the magnificent organisation of the singing in the Temple at Jerusalem. He founded a school for singers, and a considerable band, which at last reached the number of 4,000 trumpeters." The "Lyre of Orpheus," and the ratios derived from its traditional four strings, are far more fully explained. The Ambrosian and Gregorian scales follow, as well as the first attempts at polyphonic music in the tenth and eleventh centuries. Guy d'Arezzo is still credited with the invention of modern notation, though he really only used "neumas" and two clef lines, or staves, one yellow and one red. Luther, who doubtless was a musician, is accepted as the reformer of music as well as of the church. The modern and Pythagorean scales are numerically compared, and then transposition and modulation lead to a description of temperament. "The temperate scale," as it is here termed, "starts with the principle of making no distinction between the major and minor tone, of confounding the major semitone with the minor, and of considering the sharp of a note as equal to the flat of the succeeding note; so that all the notes of an octave are reduced to twelve only, which are considered equidistant from each other."

The difficulties in the way of true intonation, especially in the case of keyed instruments, are fairly stated, and the writer concludes with a remark in which we cordially sympathise:—"It does not, therefore, appear impossible, or even really difficult, for the full orchestra and chorus to perform a piece of music in the exact scale."

The subject of the eighth chapter is quality or "Timbre," in which Helmholtz's views are expounded and illustrated by good diagrams of optical and graphical methods, and of Koenig's ingenious apparatus. The last section draws distinctions between music as a science and as an art, and between Italian and German music; giving a remarkably fair estimate of Rossini's position as a melodist, rather than as a scientific musician, and on the other hand a deserved tribute of praise to the lofty character and deep dramatic feeling which, "notwithstanding some too realistic exaggerations, and some trivialities," mark the compositions of Richard Wagner.

On the whole, this volume is easily and clearly written, although, as already noted, it is rather sketchy and hurried in the historical part. There are other minor typographical, or probably translator's, oversights, such as Terpandro for Terpander, Cornue for Cornu, Orlando Tasso for Orlando Lasso, and harmonicon for harmonium. But it affords a readable *résumé* of a subject which is daily rising in scientific, as well as in purely artistic interest.

W. H. STONE

TWO BOOKS ON LANGUAGE

The Existence of Mixed Languages. By J. C. Clough. (London: Longmans, Green, and Co., 1870.)

On the Comparative Method of Learning Foreign Languages. By L. J. V. Gerard. (Leicester: 1876.)

THE existence of mixed languages is one of the vexed questions of Comparative Philology. By a mixed language is meant a language in which the grammars of two or more different languages have been fused together, not one in which the vocabulary is of a heterogeneous character. Mixed languages in the latter sense are, of course, plentiful enough; in fact there are languages like the Basque or the Telugu, in which the proportion of borrowed words is larger than that of native words. But though words may be borrowed, it is a grave question whether the expression of grammatical relations can be, and modern philology has been inclined to deny the possibility of such an occurrence. The grammar of one speech may be influenced by that of another, existing machinery being adapted to express grammatical conceptions introduced from abroad, or foreign modes of forming the sentence being imitated, and the idioms of one language may even be adopted by another, but anything beyond this is extremely unlikely. It is in grammar and structure that languages differ from one another; the expression of the relations of grammar embodies the mode in which a particular community thinks, and a change in their expression is equivalent to a change in the mode of thinking. And this mode of thinking is the result of a long succession of past experiences and stereotyped habits of thought.

Mr. Clough boldly challenges the orthodox view of the impossibility of mixed languages. He endeavours to support his heresy by an appeal to contrary instances. Thus he points to jargons like the Chinook, or Pigeon-English, to languages like Maltese or Hindustani, which have grown out of jargons, and finally to independent forms of speech like Turkish or Persian, in which he believes he finds examples of mixed languages. But he does not always distinguish between mixture in the grammar and in the vocabulary, or between the borrowing of idioms and of grammatical conceptions. Hence a large part of his book, that which deals with languages like the Keltic, the Romanic, and the Teutonic, is quite beside the point. On the other hand, he has omitted to notice some very important cases of an apparently mixed grammar, such as the Pahlavi of ancient Persia, the Assamese and kindred dialects of Northern India, and the Sub-Semitic languages of Africa. A full discussion of the phenomena presented by these might lead to a modification of the orthodox doctrine, at all events so far as the flexion of the noun is concerned. As it is, Mr. Clough has brought forward a good deal of pertinent matter, though a larger amount of what has nothing to do with the question in dispute. The whole of the second part of his book, for example, which relates to English, might easily have been spared. The book, however, is full of information, and the facts collected are usually accurate.

M. Gerard has reprinted a lecture delivered by him at the Leicester Museum, on the scientific, and therefore the natural, way of learning foreign languages. The lecture is an excellent one, at once original, clear, and practical. M. Gerard is no friend to existing systems of teaching French and German, and he is undoubtedly right in his belief that their failure is due to a neglect of the way in which children learn their own or a foreign tongue. Instead of beginning by studying the rules of grammar and loading the memory with lists of isolated words, the child speaks in sentences, and only gradually learns to distinguish the several words of a sentence and the parts of